

### 3. Ion Exchange

**TABLE 8-9  
ION EXCHANGE CO-CURRENT ALTERNATIVE  
ESTIMATED CAPITAL COSTS**

<b>DESCRIPTION</b>	<b>QUANTITY</b>	<b>UNITS</b>	<b>UNIT COST</b>	<b>TOTAL COST</b>
Ion Exchange Equipment	1	LS	\$815,000	\$815,000
Ion Exchange Facilities	1	LS	\$1,142,000	\$1,142,000
Booster Pump Station	1	LS	\$128,000	\$128,000
Plant Piping	1	LS	\$194,000	\$194,000
Waste Water Disposal to San. Sewer	1	LS	\$125,000	\$125,000
Sanitary Sewer Improvements	1	LS	\$100,000	\$100,000
Slurry Carbon System <sup>1</sup>	1	LS	\$339,000	\$339,000
Filter Improvements <sup>1</sup>	1	LS	\$77,000	\$77,000
New River Intake <sup>1</sup>	1	LS	\$324,000	\$324,000
Upgrading SCADA System <sup>1</sup>	1	LS	\$300,000	\$300,000
<b>Sub-Total</b>				<b>\$3,544,000</b>
<b>20% Contingency</b>				<b>\$ 708,800</b>
<b>Total Construction Cost</b>				<b>\$4,252,800</b>
<b>Other Project Costs</b>				<b>\$2,044,490</b>
<b>Total Project Cost</b>				<b>\$6,297,290</b>

<sup>1</sup>CTE has recommended that CIWC move forward with water treatment plant improvements to ensure compliance with water quality regulations that include carbon slurry system, filter improvements, new river intakes and upgrading of the SCADA system.

**TABLE 8-10**  
**ION EXCHANGE CO-CURRENT ALTERNATIVE**  
**ESTIMATED OPERATING COSTS**

<b>DESCRIPTION</b>	<b>TOTAL/YR</b>	<b>COST/YR</b>
Pumping Costs	85.7 MG	\$1425
Salt Cost	340,400 lb	\$11,920
Wastewater Volume Charge	1.63 MG	\$91,120
Sulfate Wastewater Charge	28,600 lb	\$16,390
Resin Replacement Cost	1256 cu ft	\$6,775
<b>Total</b>		<b>\$127,630</b>
	<b>SAY</b>	<b>\$128,000</b>

**TABLE 8-11**  
**ION EXCHANGE CO-CURRENT ALTERNATIVE**  
**PRESENT VALUE OF REVENUE REQUIRED**

A	B	C	D	E	F	G	H	I	J	K	P.V. of Revenue Requirement @ 10%
Year	Total Capital Cost	Year - End Undepr. Factor	Undepreciated Capital	Pretax Rate of Return	Dollar Rate of Return (D x E)	Total O&M Expense *	Depreciation (B x 3.0%)	Property Taxes @2%	Total Capital Return (F + H + I)	Total Rev. Req'mt (G + J)	
1	\$6,297,290	0.970	\$6,108,371	17.00%	\$1,038,423	\$128,000	\$188,919	\$122,167	\$1,349,509	\$1,477,509	\$1,343,190
2	\$6,297,290	0.945	\$5,919,453	17.00%	\$1,006,307	\$131,840	\$188,919	\$118,389	\$1,313,615	\$1,445,455	\$1,194,591
3	\$6,297,290	0.920	\$5,730,534	17.00%	\$974,191	\$135,795	\$188,919	\$114,611	\$1,277,720	\$1,413,515	\$1,061,995
4	\$6,297,290	0.895	\$5,541,615	17.00%	\$942,075	\$139,869	\$188,919	\$110,832	\$1,241,826	\$1,381,695	\$943,716
5	\$6,297,290	0.870	\$5,352,697	17.00%	\$909,958	\$144,065	\$188,919	\$107,054	\$1,205,931	\$1,349,996	\$838,241
6	\$6,297,290	0.845	\$5,163,778	17.00%	\$877,842	\$148,387	\$188,919	\$103,276	\$1,170,036	\$1,318,424	\$744,216
7	\$6,297,290	0.820	\$4,974,859	17.00%	\$845,726	\$152,839	\$188,919	\$99,497	\$1,134,142	\$1,286,981	\$660,425
8	\$6,297,290	0.795	\$4,785,940	17.00%	\$813,610	\$157,424	\$188,919	\$95,719	\$1,098,247	\$1,255,671	\$585,780
9	\$6,297,290	0.770	\$4,597,022	17.00%	\$781,494	\$162,147	\$188,919	\$91,940	\$1,062,353	\$1,224,499	\$519,307
10	\$6,297,290	0.745	\$4,408,103	17.00%	\$749,378	\$167,011	\$188,919	\$88,162	\$1,026,458	\$1,193,469	\$460,134
11	\$6,297,290	0.720	\$4,219,184	17.00%	\$717,261	\$172,021	\$188,919	\$84,384	\$990,564	\$1,162,585	\$407,479
12	\$6,297,290	0.695	\$4,030,266	17.00%	\$685,145	\$177,182	\$188,919	\$80,605	\$954,669	\$1,131,851	\$360,643
13	\$6,297,290	0.670	\$3,841,347	17.00%	\$653,029	\$182,497	\$188,919	\$76,827	\$918,775	\$1,101,272	\$318,999
14	\$6,297,290	0.645	\$3,652,428	17.00%	\$620,913	\$187,972	\$188,919	\$73,049	\$882,880	\$1,070,852	\$281,989
15	\$6,297,290	0.620	\$3,463,510	17.00%	\$588,797	\$193,611	\$188,919	\$69,270	\$846,986	\$1,040,597	\$249,111
16	\$6,297,290	0.595	\$3,274,591	17.00%	\$556,680	\$199,420	\$188,919	\$65,492	\$811,091	\$1,010,511	\$219,917
17	\$6,297,290	0.570	\$3,085,672	17.00%	\$524,564	\$205,402	\$188,919	\$61,713	\$775,196	\$980,599	\$194,006
18	\$6,297,290	0.545	\$2,896,753	17.00%	\$492,448	\$211,564	\$188,919	\$57,935	\$739,302	\$950,866	\$171,022
19	\$6,297,290	0.520	\$2,707,835	17.00%	\$460,332	\$217,911	\$188,919	\$54,157	\$703,407	\$921,319	\$150,643
20	\$6,297,290	0.495	\$2,518,916	17.00%	\$428,216	\$224,449	\$188,919	\$50,378	\$667,513	\$891,962	\$132,584
21	\$6,297,290	0.470	\$2,329,997	17.00%	\$396,100	\$231,182	\$188,919	\$46,600	\$631,618	\$862,800	\$116,591
22	\$6,297,290	0.445	\$2,141,079	17.00%	\$363,983	\$238,118	\$188,919	\$42,822	\$595,724	\$833,841	\$102,434
23	\$6,297,290	0.420	\$1,952,160	17.00%	\$331,867	\$245,261	\$188,919	\$39,043	\$559,829	\$805,090	\$89,911
24	\$6,297,290	0.395	\$1,763,241	17.00%	\$299,751	\$252,619	\$188,919	\$35,265	\$523,935	\$776,554	\$78,840
25	\$6,297,290	0.370	\$1,574,323	17.00%	\$267,635	\$260,198	\$188,919	\$31,486	\$488,040	\$748,238	\$69,059
26	\$6,297,290	0.345	\$1,385,404	17.00%	\$235,519	\$268,004	\$188,919	\$27,708	\$452,145	\$720,149	\$60,424
27	\$6,297,290	0.320	\$1,196,485	17.00%	\$203,402	\$276,044	\$188,919	\$23,930	\$416,251	\$692,295	\$52,807
28	\$6,297,290	0.295	\$1,007,566	17.00%	\$171,286	\$284,325	\$188,919	\$20,151	\$380,356	\$664,681	\$46,091
29	\$6,297,290	0.270	\$818,648	17.00%	\$139,170	\$292,855	\$188,919	\$16,373	\$344,462	\$637,317	\$40,176
30	\$6,297,290	0.245	\$629,729	17.00%	\$107,054	\$301,640	\$188,919	\$12,595	\$308,567	\$610,208	\$34,970
										<b>TOTAL:</b>	\$11,529,291

\* An annual inflation rate of 3% has been applied to the total O&M expense.

**TABLE 8-12**  
**ION EXCHANGE COUNTER-CURRENT ALTERNATIVE**  
**ESTIMATED CAPITAL COSTS**

<b>DESCRIPTION</b>	<b>QUANTITY</b>	<b>UNITS</b>	<b>UNIT COST</b>	<b>TOTAL COST</b>
Ion Exchange Equipment	1	LS	\$870,000	\$870,000
Ion Exchange Facilities	1	LS	\$1,142,000	\$1,142,000
Booster Pump Station	1	LS	\$128,000	\$128,000
Plant Piping	1	LS	\$194,000	\$194,000
Waste Water Disposal to San. Sewer	1	LS	\$125,000	\$125,000
Sanitary Sewer Improvements	1	LS	\$100,000	\$100,000
Slurry Carbon System <sup>1</sup>	1	LS	\$339,000	\$339,000
Filter Improvements <sup>1</sup>	1	LS	\$77,000	\$77,000
New River Intake <sup>1</sup>	1	LS	\$324,000	\$324,000
Upgrading SCADA System <sup>1</sup>	1	LS	\$300,000	\$300,000
Sub-Total				\$3,599,000
20% Contingency				\$ 719,800
Total Construction Cost				\$4,318,800
Other Project Costs				\$2,060,990
<b>Total Project Cost</b>				<b>\$6,379,790</b>

<sup>1</sup>CTE has recommended that CIWC move forward with water treatment plant improvements to ensure compliance with water quality regulations that include carbon slurry system, filter improvements, new river intakes and upgrading of the SCADA system.

**TABLE 8-13**  
**ION EXCHANGE COUNTER-CURRENT ALTERNATIVE**  
**ESTIMATED OPERATING COSTS**

<b><u>DESCRIPTION</u></b>	<b><u>TOTAL/YR</u></b>	<b><u>COST/YR</u></b>
Pumping Costs	78.7 MG	\$1310
Salt Cost	209,500 lb	\$7340
Wastewater Volume Charge	1.138 MG	\$63,620
Sulfate Wastewater Charge	26,200 lb	\$15,020
Resin Replacement Cost	1572 cu ft	\$8500
<b>Total</b>	<b>SAY</b>	<b>\$95,790</b> <b>\$100,000</b>

**TABLE 8-14**  
**ION EXCHANGE COUNTER-CURRENT ALTERNATIVE**  
**PRESENT VALUE OF REVENUE REQUIRED**

A	B	C	D	E	F	G	H	I	J	K	P.V. of Revenue Requirement @ 10%
Year	Total Capital Cost	Year - End Undepr. Factor	Undepreciated Capital	Pretax Rate of Return	Dollar Rate of Return (D x E)	Total O&M Expense *	Depreciation (B x 3.0%)	Property Taxes @2%	Total Capital Return (F + H + I)	Total Rev. Req'mt (G + J)	
1	\$6,379,790	0.970	\$6,188,396	17.00%	\$1,052,027	\$100,000	\$191,394	\$123,768	\$1,367,189	\$1,467,189	\$1,333,808
2	\$6,379,790	0.945	\$5,997,003	17.00%	\$1,019,490	\$103,000	\$191,394	\$119,940	\$1,330,824	\$1,433,824	\$1,184,979
3	\$6,379,790	0.920	\$5,805,609	17.00%	\$986,954	\$106,090	\$191,394	\$116,112	\$1,294,459	\$1,400,549	\$1,052,253
4	\$6,379,790	0.895	\$5,614,215	17.00%	\$954,417	\$109,273	\$191,394	\$112,284	\$1,258,095	\$1,367,367	\$933,930
5	\$6,379,790	0.870	\$5,422,822	17.00%	\$921,880	\$112,551	\$191,394	\$108,456	\$1,221,730	\$1,334,281	\$828,483
6	\$6,379,790	0.845	\$5,231,428	17.00%	\$889,343	\$115,927	\$191,394	\$104,629	\$1,185,365	\$1,301,292	\$734,546
7	\$6,379,790	0.820	\$5,040,034	17.00%	\$856,806	\$119,405	\$191,394	\$100,801	\$1,149,000	\$1,268,405	\$650,893
8	\$6,379,790	0.795	\$4,848,640	17.00%	\$824,269	\$122,987	\$191,394	\$96,973	\$1,112,635	\$1,235,623	\$576,427
9	\$6,379,790	0.770	\$4,657,247	17.00%	\$791,732	\$126,677	\$191,394	\$93,145	\$1,076,271	\$1,202,948	\$510,167
10	\$6,379,790	0.745	\$4,465,853	17.00%	\$759,195	\$130,477	\$191,394	\$89,317	\$1,039,906	\$1,170,383	\$451,233
11	\$6,379,790	0.720	\$4,274,459	17.00%	\$726,658	\$134,392	\$191,394	\$85,489	\$1,003,541	\$1,137,933	\$398,838
12	\$6,379,790	0.695	\$4,083,066	17.00%	\$694,121	\$138,423	\$191,394	\$81,661	\$967,176	\$1,105,600	\$352,278
13	\$6,379,790	0.670	\$3,891,672	17.00%	\$661,584	\$142,576	\$191,394	\$77,833	\$930,811	\$1,073,387	\$310,922
14	\$6,379,790	0.645	\$3,700,278	17.00%	\$629,047	\$146,853	\$191,394	\$74,006	\$894,447	\$1,041,300	\$274,207
15	\$6,379,790	0.620	\$3,508,885	17.00%	\$596,510	\$151,259	\$191,394	\$70,178	\$858,082	\$1,009,341	\$241,628
16	\$6,379,790	0.595	\$3,317,491	17.00%	\$563,973	\$155,797	\$191,394	\$66,350	\$821,717	\$977,514	\$212,735
17	\$6,379,790	0.570	\$3,126,097	17.00%	\$531,437	\$160,471	\$191,394	\$62,522	\$785,352	\$945,823	\$187,126
18	\$6,379,790	0.545	\$2,934,703	17.00%	\$498,900	\$165,285	\$191,394	\$58,694	\$748,987	\$914,272	\$164,440
19	\$6,379,790	0.520	\$2,743,310	17.00%	\$466,363	\$170,243	\$191,394	\$54,866	\$712,623	\$882,866	\$144,356
20	\$6,379,790	0.495	\$2,551,916	17.00%	\$433,826	\$175,351	\$191,394	\$51,038	\$676,258	\$851,608	\$126,586
21	\$6,379,790	0.470	\$2,360,522	17.00%	\$401,289	\$180,611	\$191,394	\$47,210	\$639,893	\$820,504	\$110,875
22	\$6,379,790	0.445	\$2,169,129	17.00%	\$368,752	\$186,029	\$191,394	\$43,383	\$603,528	\$789,558	\$96,994
23	\$6,379,790	0.420	\$1,977,735	17.00%	\$336,215	\$191,610	\$191,394	\$39,555	\$567,163	\$758,774	\$84,738
24	\$6,379,790	0.395	\$1,786,341	17.00%	\$303,678	\$197,359	\$191,394	\$35,727	\$530,799	\$728,157	\$73,927
25	\$6,379,790	0.370	\$1,594,948	17.00%	\$271,141	\$203,279	\$191,394	\$31,899	\$494,434	\$697,713	\$64,396
26	\$6,379,790	0.345	\$1,403,554	17.00%	\$238,604	\$209,378	\$191,394	\$28,071	\$458,069	\$667,447	\$56,002
27	\$6,379,790	0.320	\$1,212,160	17.00%	\$206,067	\$215,659	\$191,394	\$24,243	\$421,704	\$637,363	\$48,617
28	\$6,379,790	0.295	\$1,020,766	17.00%	\$173,530	\$222,129	\$191,394	\$20,415	\$385,339	\$607,468	\$42,124
29	\$6,379,790	0.270	\$829,373	17.00%	\$140,993	\$228,793	\$191,394	\$16,587	\$348,975	\$577,767	\$36,422
30	\$6,379,790	0.245	\$637,979	17.00%	\$108,456	\$235,657	\$191,394	\$12,760	\$312,610	\$548,266	\$31,420
										<b>TOTAL:</b>	<b>\$11,315,352</b>

\* An annual inflation rate of 3% has been applied to the total O&M expense.

**TABLE 8-15**  
**ION EXCHANGE CONTINUOUS CONTACTOR ALTERNATIVE**  
**ESTIMATED CAPITAL COSTS**

<b>DESCRIPTION</b>	<b>QUANTITY</b>	<b>UNITS</b>	<b>UNIT COST</b>	<b>TOTAL COST</b>
Ion Exchange Equipment	1	LS	\$1,880,000	\$1,880,000
Ion Exchange Facilities	1	LS	\$1,142,000	\$1,142,000
Booster Pump Station	1	LS	\$128,000	\$128,000
Plant Piping	1	LS	\$194,000	\$194,000
Waste Water Disposal to San. Sewer	1	LS	\$125,000	\$125,000
Sanitary Sewer Improvements	1	LS	\$100,000	\$100,000
Slurry Carbon System <sup>1</sup>	1	LS	\$339,000	\$339,000
Filter Improvements <sup>1</sup>	1	LS	\$77,000	\$77,000
New River Intake <sup>1</sup>	1	LS	\$324,000	\$324,000
Upgrading SCADA System <sup>1</sup>	1	LS	\$300,000	\$300,000
<b>Sub-Total</b>				<b>\$4,609,000</b>
<b>20% Contingency</b>				<b>\$921,800</b>
<b>Total Construction Cost</b>				<b>\$5,530,800</b>
<b>Other Project Costs</b>				<b>\$ 2,263,990</b>
<b>Total Project Cost</b>				<b>\$7,894,790</b>

<sup>1</sup>CTE has recommended that CIWC move forward with water treatment plant improvements to ensure compliance with water quality regulations that include carbon slurry system, filter improvements, new river intakes and upgrading of the SCADA system.

**TABLE 8-16**  
**ION EXCHANGE CONTINUOUS CONTACTOR ALTERNATIVE**  
**ESTIMATED OPERATING COSTS**

<b><u>DESCRIPTION</u></b>	<b><u>TOTAL/YR</u></b>	<b><u>COST/YR</u></b>
Pumping Costs	78.7 MG	\$1310
Salt Cost	196,800 lb	\$6890
Wastewater Volume Charge	0.315 MG	\$17,610
Sulfate Wastewater Charge	26,200 lb	\$15,020
Resin Replacement Cost	725 cu ft	\$3910
<b>Total</b>	<b>SAY</b>	<b>\$44,740</b> <b>\$45,000</b>



**TABLE 8-17**  
**ION EXCHANGE CONTINUOUS CONTACTOR ALTERNATIVE**  
**PRESENT VALUE OF REVENUE REQUIRED**

A	B	C	D	E	F	G	H	I	J	K	P.V. of Revenue Requirement @ 10%
Year	Total Capital Cost	Year - End Undepr. Factor	Undepriciated Capital	Pretax Rate of Return	Dollar Rate of Return (D x E)	Total O&M Expense *	Depreciation (B x 3.0%)	Property Taxes @2%	Total Capital Return (F + H + I)	Total Rev. Req'mt (G + J)	
1	\$7,894,790	0.970	\$7,657,946	17.00%	\$1,301,851	\$45,000	\$236,844	\$153,159	\$1,691,853	\$1,736,853	\$1,578,958
2	\$7,894,790	0.945	\$7,421,103	17.00%	\$1,261,587	\$46,350	\$236,844	\$148,422	\$1,646,853	\$1,693,203	\$1,399,341
3	\$7,894,790	0.920	\$7,184,259	17.00%	\$1,221,324	\$47,741	\$236,844	\$143,685	\$1,601,853	\$1,649,593	\$1,239,364
4	\$7,894,790	0.895	\$6,947,415	17.00%	\$1,181,061	\$49,173	\$236,844	\$138,948	\$1,556,853	\$1,606,025	\$1,096,937
5	\$7,894,790	0.870	\$6,710,572	17.00%	\$1,140,797	\$50,648	\$236,844	\$134,211	\$1,511,852	\$1,562,500	\$970,190
6	\$7,894,790	0.845	\$6,473,728	17.00%	\$1,100,534	\$52,167	\$236,844	\$129,475	\$1,466,852	\$1,519,019	\$857,447
7	\$7,894,790	0.820	\$6,236,884	17.00%	\$1,060,270	\$53,732	\$236,844	\$124,738	\$1,421,852	\$1,475,584	\$757,208
8	\$7,894,790	0.795	\$6,000,040	17.00%	\$1,020,007	\$55,344	\$236,844	\$120,001	\$1,376,851	\$1,432,196	\$668,130
9	\$7,894,790	0.770	\$5,763,197	17.00%	\$979,743	\$57,005	\$236,844	\$115,264	\$1,331,851	\$1,388,856	\$589,010
10	\$7,894,790	0.745	\$5,526,353	17.00%	\$939,480	\$58,715	\$236,844	\$110,527	\$1,286,851	\$1,345,566	\$518,774
11	\$7,894,790	0.720	\$5,289,509	17.00%	\$899,217	\$60,476	\$236,844	\$105,790	\$1,241,850	\$1,302,327	\$456,458
12	\$7,894,790	0.695	\$5,052,666	17.00%	\$858,953	\$62,291	\$236,844	\$101,053	\$1,196,850	\$1,259,141	\$401,201
13	\$7,894,790	0.670	\$4,815,822	17.00%	\$818,690	\$64,159	\$236,844	\$96,316	\$1,151,850	\$1,216,009	\$352,235
14	\$7,894,790	0.645	\$4,578,978	17.00%	\$778,426	\$66,084	\$236,844	\$91,580	\$1,106,850	\$1,172,934	\$308,870
15	\$7,894,790	0.620	\$4,342,135	17.00%	\$738,163	\$68,067	\$236,844	\$86,843	\$1,061,849	\$1,129,916	\$270,493
16	\$7,894,790	0.595	\$4,105,291	17.00%	\$697,899	\$70,109	\$236,844	\$82,106	\$1,016,849	\$1,086,957	\$236,554
17	\$7,894,790	0.570	\$3,868,447	17.00%	\$657,636	\$72,212	\$236,844	\$77,369	\$971,849	\$1,044,060	\$206,562
18	\$7,894,790	0.545	\$3,631,603	17.00%	\$617,373	\$74,378	\$236,844	\$72,632	\$926,848	\$1,001,226	\$180,079
19	\$7,894,790	0.520	\$3,394,760	17.00%	\$577,109	\$76,609	\$236,844	\$67,895	\$881,848	\$958,458	\$156,715
20	\$7,894,790	0.495	\$3,157,916	17.00%	\$536,846	\$78,908	\$236,844	\$63,158	\$836,848	\$915,756	\$136,121
21	\$7,894,790	0.470	\$2,921,072	17.00%	\$496,582	\$81,275	\$236,844	\$58,421	\$791,847	\$873,122	\$117,986
22	\$7,894,790	0.445	\$2,684,229	17.00%	\$456,319	\$83,713	\$236,844	\$53,685	\$746,847	\$830,560	\$102,031
23	\$7,894,790	0.420	\$2,447,385	17.00%	\$416,055	\$86,225	\$236,844	\$48,948	\$701,847	\$788,071	\$88,010
24	\$7,894,790	0.395	\$2,210,541	17.00%	\$375,792	\$88,811	\$236,844	\$44,211	\$656,847	\$745,658	\$75,703
25	\$7,894,790	0.370	\$1,973,698	17.00%	\$335,529	\$91,476	\$236,844	\$39,474	\$611,846	\$703,322	\$64,914
26	\$7,894,790	0.345	\$1,736,854	17.00%	\$295,265	\$94,220	\$236,844	\$34,737	\$566,846	\$661,066	\$55,467
27	\$7,894,790	0.320	\$1,500,010	17.00%	\$255,002	\$97,047	\$236,844	\$30,000	\$521,846	\$618,892	\$47,208
28	\$7,894,790	0.295	\$1,263,166	17.00%	\$214,738	\$99,958	\$236,844	\$25,263	\$476,845	\$576,803	\$39,997
29	\$7,894,790	0.270	\$1,026,323	17.00%	\$174,475	\$102,957	\$236,844	\$20,526	\$431,845	\$534,802	\$33,714
30	\$7,894,790	0.245	\$789,479	17.00%	\$134,211	\$106,045	\$236,844	\$15,790	\$386,845	\$492,890	\$28,247
										<b>TOTAL:</b>	\$13,033,923

\* An annual inflation rate of 3% has been applied to the total O&M expense.

4. Reverse Osmosis

**TABLE 8-18  
REVERSE OSMOSIS ALTERNATIVE  
ESTIMATED CAPITAL COSTS**

<b>DESCRIPTION</b>	<b>QUANTITY</b>	<b>UNITS</b>	<b>UNIT COST</b>	<b>TOTAL COST</b>
Reverse Osmosis Equipment and Facilities	1	LS	\$2,925,000	\$2,925,000
Plant Piping	1	LS	\$200,000	\$200,000
Waste Water Disposal to San. Sewer	1	LS	\$125,000	\$125,000
Sanitary Sewer Improvements	1	LS	\$100,000	\$100,000
Other Water Treatment Plant Improvements <sup>1</sup>	1	LS	\$1,040,000	\$1,040,000
<b>Sub-Total</b>				<b>\$4,390,000</b>
<b>20% Contingency</b>				<b>\$878,000</b>
<b>Total Construction Cost</b>				<b>\$5,268,000</b>
<b>Other Project Costs</b>				<b>\$2,298,290</b>
<b>Total Project Cost</b>				<b>\$7,566,290</b>

<sup>1</sup>CTE has recommended that CIWC move forward with water treatment plant improvements to ensure compliance with water quality regulations that include carbon slurry system, filter improvements, new river intakes and upgrading of the SCADA system.

**TABLE 8-19**  
**REVERSE OSMOSIS ALTERNATIVE**  
**ESTIMATED OPERATING COSTS**

<b><u>DESCRIPTION</u></b>	<b><u>TOTAL/YR</u></b>	<b><u>COST/YR</u></b>
Chemical pre- & post- treatment		\$6000
Energy		\$6000
Membrane Replacement 10 Yr. Life		\$47,000
Wastewater Volume	6.3 MG	\$355,000
Wastewater Sulfate Charge	31,590 lb	\$20,000
<b>Total</b>		<b>\$434,000</b>

**TABLE 8-20**  
**REVERSE OSMOSIS ALTERNATIVE**  
**PRESENT VALUE OF REVENUE REQUIRED**

A	B	C	D	E	F	G	H	I	J	K	P.V. of Revenue Requirement @ 10%
Year	Total Capital Cost	Year - End Undepr. Factor	Undepreciated Capital	Pretax Rate of Return	Dollar Rate of Return (D x E)	Total O&M Expense *	Depreciation (B x 3.0%)	Property Taxes @2%	Total Capital Return (F + H + I)	Total Rev. Req'mt (G + J)	
1	\$7,566,290	0.970	\$7,339,301	17.00%	\$1,247,681	\$434,000	\$226,989	\$146,786	\$1,621,456	\$2,055,456	\$1,868,596
2	\$7,566,290	0.945	\$7,112,313	17.00%	\$1,209,093	\$447,020	\$226,989	\$142,246	\$1,578,328	\$2,025,348	\$1,673,841
3	\$7,566,290	0.920	\$6,885,324	17.00%	\$1,170,505	\$460,431	\$226,989	\$137,706	\$1,535,200	\$1,995,631	\$1,499,347
4	\$7,566,290	0.895	\$6,658,335	17.00%	\$1,131,917	\$474,244	\$226,989	\$133,167	\$1,492,072	\$1,966,316	\$1,343,020
5	\$7,566,290	0.870	\$6,431,347	17.00%	\$1,093,329	\$488,471	\$226,989	\$128,627	\$1,448,945	\$1,937,415	\$1,202,983
6	\$7,566,290	0.845	\$6,204,358	17.00%	\$1,054,741	\$503,125	\$226,989	\$124,087	\$1,405,817	\$1,908,942	\$1,077,548
7	\$7,566,290	0.820	\$5,977,369	17.00%	\$1,016,153	\$518,219	\$226,989	\$119,547	\$1,362,689	\$1,880,908	\$965,203
8	\$7,566,290	0.795	\$5,750,380	17.00%	\$977,565	\$533,765	\$226,989	\$115,008	\$1,319,561	\$1,853,326	\$864,590
9	\$7,566,290	0.770	\$5,523,392	17.00%	\$938,977	\$549,778	\$226,989	\$110,468	\$1,276,433	\$1,826,211	\$774,492
10	\$7,566,290	0.745	\$5,296,403	17.00%	\$900,389	\$566,272	\$226,989	\$105,928	\$1,233,305	\$1,799,577	\$693,815
11	\$7,566,290	0.720	\$5,069,414	17.00%	\$861,800	\$583,260	\$226,989	\$101,388	\$1,190,177	\$1,773,437	\$621,579
12	\$7,566,290	0.695	\$4,842,426	17.00%	\$823,212	\$600,757	\$226,989	\$96,849	\$1,147,050	\$1,747,807	\$556,905
13	\$7,566,290	0.670	\$4,615,437	17.00%	\$784,624	\$618,780	\$226,989	\$92,309	\$1,103,922	\$1,722,702	\$499,005
14	\$7,566,290	0.645	\$4,388,448	17.00%	\$746,036	\$637,344	\$226,989	\$87,769	\$1,060,794	\$1,698,137	\$447,173
15	\$7,566,290	0.620	\$4,161,460	17.00%	\$707,448	\$656,464	\$226,989	\$83,229	\$1,017,666	\$1,674,130	\$400,773
16	\$7,566,290	0.595	\$3,934,471	17.00%	\$668,860	\$676,158	\$226,989	\$78,689	\$974,538	\$1,650,696	\$359,240
17	\$7,566,290	0.570	\$3,707,482	17.00%	\$630,272	\$696,443	\$226,989	\$74,150	\$931,410	\$1,627,853	\$322,062
18	\$7,566,290	0.545	\$3,480,493	17.00%	\$591,684	\$717,336	\$226,989	\$69,610	\$888,282	\$1,605,618	\$288,785
19	\$7,566,290	0.520	\$3,253,505	17.00%	\$553,096	\$738,856	\$226,989	\$65,070	\$845,155	\$1,584,011	\$258,998
20	\$7,566,290	0.495	\$3,026,516	17.00%	\$514,508	\$761,022	\$226,989	\$60,530	\$802,027	\$1,563,048	\$232,337
21	\$7,566,290	0.470	\$2,799,527	17.00%	\$475,920	\$783,852	\$226,989	\$55,991	\$758,899	\$1,542,751	\$208,473
22	\$7,566,290	0.445	\$2,572,539	17.00%	\$437,332	\$807,368	\$226,989	\$51,451	\$715,771	\$1,523,139	\$187,111
23	\$7,566,290	0.420	\$2,345,550	17.00%	\$398,743	\$831,589	\$226,989	\$46,911	\$672,643	\$1,504,232	\$167,990
24	\$7,566,290	0.395	\$2,118,561	17.00%	\$360,155	\$856,537	\$226,989	\$42,371	\$629,515	\$1,486,052	\$150,872
25	\$7,566,290	0.370	\$1,891,573	17.00%	\$321,567	\$882,233	\$226,989	\$37,831	\$586,387	\$1,468,620	\$135,548
26	\$7,566,290	0.345	\$1,664,584	17.00%	\$282,979	\$908,700	\$226,989	\$33,292	\$543,260	\$1,451,959	\$121,827
27	\$7,566,290	0.320	\$1,437,595	17.00%	\$244,391	\$935,961	\$226,989	\$28,752	\$500,132	\$1,436,092	\$109,542
28	\$7,566,290	0.295	\$1,210,606	17.00%	\$205,803	\$964,039	\$226,989	\$24,212	\$457,004	\$1,421,043	\$98,540
29	\$7,566,290	0.270	\$983,618	17.00%	\$167,215	\$992,961	\$226,989	\$19,672	\$413,876	\$1,406,837	\$88,686
30	\$7,566,290	0.245	\$756,629	17.00%	\$128,627	\$1,022,749	\$226,989	\$15,133	\$370,748	\$1,393,498	\$79,859
										<b>TOTAL:</b>	<b>\$17,298,741</b>

\* An annual inflation rate of 3% has been applied to the total O&M expense.

**TABLE 8-21  
COMPARISON OF ALTERNATIVES**

<b><u>TREATMENT ALTERNATIVE</u></b>	<b><u>CAPITAL COST ESTIMATE</u></b>	<b><u>OPERATION &amp; MAINTENANCE COST ESTIMATE (1999)</u></b>	<b><u>PRESENT VALUE OF REVENUE REQUIREMENT ESTIMATE</u></b>
Side Stream Storage (Canyon Lake)	\$12,936,290	\$45,000	\$21,604,304
Groundwater	\$12,663,290	\$25,000	\$20,770,010
Ion Exchange (Co-Current)	\$6,297,290	\$128,000	\$11,529,291
Ion Exchange (Counter-Current)	\$6,379,790	\$100,000	\$11,315,352
Ion Exchange (Continuous Contactor)	\$7,894,790	\$45,000	\$13,033,923
Reverse Osmosis	\$7,566,290	\$434,000	\$17,298,741

As Table 8-21 shows, the groundwater and side channel storage alternative require more initial capital expenditure, while the ion exchange and reverse osmosis alternatives require greater long term operation and maintenance expenses. Considering the groundwater alternative, the overall cost will potentially increase depending on the required location of the wells. This would in turn, affect the cost of land and pipeline. In addition, the success of this alternative is dependent upon the assumption that there is enough groundwater available to meet the required demands and that the water quality is sufficient. Table 8-21 also indicates that in the long term, ion exchange is the most cost effective option.

## CHAPTER 9

### RECOMMENDATIONS

Based on all of the alternatives originally considered for this project, four were determined to provide feasible solutions. They included groundwater blending, ion exchange treatment of the existing water source, reverse osmosis treatment of the existing water source, and side channel storage for blending purposes. These alternatives were further developed and preliminary sizing and design was completed in order to generate estimated project capital and operational costs, as well as develop other issues such as finished water quality, waste generation, impact on current operations, ease of operation, etc. Based on the present value of revenue requirement costs developed in the preceding chapter, we recommend the counter-current ion exchange alternative for treatment of the high nitrate occurrences. We also recommend that CIWC investigate the possibility of obtaining a new or modifying an existing NPDES permit to discharge the ion exchange waste to a receiving stream. This will reduce both the capital and operating costs, as the tables now reflect the cost to discharge the waste to the Sanitary District.